DOCKET NO: 212868US0X CONT

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF	:
RICARDO COZAR, ET AL.	: EXAMINER: IP, S.
SERIAL NO: 09/940,481	:
FILED: AUGUST 29, 2001	: GROUP ART UNIT: 1742
FOR: FE-CO-NI ALLOY AND USE FOR THE MANUFACTURE OF A SHADOW MASK	:

SUPPLEMENTAL APPEAL BRIEF

COMMISSIONER FOR PATENTS
ALEXANDRIA, VIRGINIA 22313

SIR:

Responsive to the final rejection of the Office Action of September 23, 2002; the Interview Summary of November 19, 2002; and the Office communication of December 5, 2003; Applicants hereby appeal the rejections of Claims 1-18.

I. Real Party in Interest

The Real Party of Interest is Imphy S.A. located in Puteaux, France, by virtue of the assignment recorded in the U.S. Patent and Trademark Office on July 25, 1996 at Reel 8005/Frame 0626.

II. Related Appeals and Interferences

The presently appealed application is a Continuation application of U.S. Application Serial No. 08/641,233 filed on April 30, 1996, now abandoned. An Appeal Brief was filed with the Office on October 8, 1997 in the parent application. A Decision on Appeal was mailed on June 29, 2001, affirming the Examiner's rejections in the parent case. Copies of the Appeal Brief, Examiner's Answer, Reply Brief and Decision on Appeal are provided in Appendix II.

III. Status of the Claims

Claims 1-18 are pending and are appealed.

IV. Status of Amendments Filed Under 37 C.F.R. § 1.116

The Amendment and Request for Reconsideration filed with the U.S. Patent and Trademark Office on July 8, 2002, has been entered and considered.

V. Summary of the Invention

Claim 1 is drawn to an Fe-Ni-Co alloy whose composition is defined in terms of the elements therein (page 2, lines 16-24) and the relative concentration of the elements to one another (page 3, lines 4-5 and page 3, line 7), together with the physical properties of the alloy, such as martensitic transformation start point (page 4, lines 10-16). The elemental

composition of the alloy is further limited in Claims 2-6 (page 5, lines 15-19; page 5, line 24; and page 5, lines 22-26).

Independent Claim 7 is drawn to a shadow mask comprising at least one foil with holes (page 7, lines 7-9) where the foil has a specific alloy composition (page 2, lines 16-24; page 3, lines 4-5; and page 3, line 7) and physical properties such as martensitic transformation start point (page 4, lines 10-16).

Independent Claim 8 is drawn to a method that includes forming holes in a foil and drawing the resulting foil (page 7, lines 7-9) where the elemental composition of the foil is limited (page 2, lines 16-24; page 3, lines 4-5; and page 3, line 7) and the physical properties of the alloy are further limited (page 4, lines 10-16).

Independent Claim 9 is drawn to an Fe-Ni-Co alloy that consists essentially of the elements recited in the claim (page 2, lines 16-24; page 3, lines 4-5; and page 3, line 7) where the physical properties such as martensitic transformation start point further define the alloy (table on page 7, Ref. A, B and C). Physical properties of the alloy including coefficient of thermal expansion are further limited in Claim 9 (table on page 7, Ref. B). The alloy of Claim 9 is further limited in its elemental composition in dependent Claims 11-15 (page 5, lines 16-19; page 5, line 21; page 5, lines 22-26).

Independent Claim 16 is drawn to a shadow mask having at least one foil with holes containing an alloy of specific elemental composition (page 7, lines 7-9; page 2, lines 16-24; page 3, lines 4-5; page 3, line 7; table on page 7, Ref. A, B, and C). The shadow mask of dependent Claim 17 may have a narrow coefficient of thermal expansion (table on page 7, Ref. B).

Independent Claim 18 is drawn to a method that includes forming holes in a foil and drawing the foil (page 7, lines 7-9) where the foil has a specific elemental composition (page

2, lines 16-24; page 3, lines 4-5; and page 3, line 7) and specific physical properties (Table on page 7, Ref. A, B, and C).

The claims are drawn to alloy compositions that may contain elements including Ni, Co, Mn, Si, Cr, C, S, Ca and Mg (page 2, lines 16-24; as defined in Claims 1-6 and 9-15); a shadow mask containing the alloy (page 3, lines 16-18; as defined in Claims 7 and 16-17); and a method of forming a shadow mask containing the alloy (page 6, lines 1-13; as defined in Claims 8 and 18). The relative amounts of Co and Ni in the claimed alloys are related to one another by three formulae and must remain within the boundaries recited in the formulas defined in the independent claims.

Applicants have discovered that local doming which may occur in shadow masks exposed to thermal stress can be reduced if the alloy from which the shadow mask is made adheres to the compositional and/or physical property requirements of the claimed invention (page 3, lines 20-26 and page 7, lines 7-14).

The claimed alloy compositions advantageously have a low martensitic transformation start point (M_s). A low martensitic start point is advantageous because the alloy undergoes a structure change (e.g., from austentitic to martensitic) upon crossing this threshold temperature barrier (paragraph bridging pages 3 and 4). The present alloy composition is therefore advantageous in applications where shadow masks or other articles must be transported through or stored in cold environments such as those that exist in cold weather regions such as Canada and Siberia. The claimed alloy compositions have low martensitic transformation start points (e.g., less than -50°C (page 2, lines 6-7) as defined in independent Claims 1, 7 and 8 and less than -186°C (page 7, lines 3-5) as defined in independent Claims 9, 16 and 18).

The average and mean coefficients of thermal expansion of the claimed alloy compositions are related to the austenitic and martensitic structure of the alloy (page 4, last

paragraph through page 5, line 9). It is known in the art that since the coefficient of thermal expansion of the austenitic and martensitic structures may differ, the overall coefficient of thermal expansion of the alloy composition is a weighted average of the coefficient of thermal expansion of both the austenitic and martensitic structures. An austenitic structure (i.e., an alloy that has not passed through the martensitic transformation start point) exhibits a low coefficient of thermal expansion. The alloy compositions of the independent claims overcome some of the distortion and doming problems associated with prior art iron based alloys (page 2, line 4 through page 3, line 18 and page 3, line 23 through page 4, line 16).

VI. Issues

A. Whether Claims 1-18 are obvious within the meaning of 35 U.S.C. § 103 in view of patents to Inoue (U.S. 5,234,512), Fukuda (U.S. 5,236,522), Ishikawa (U.S. 4,832,908) or Kato (U.S. 5,164,021).

B. Whether Claims 1-18 contain subject matter which was described in the specification in such a way as to enable one skilled in the art to make and/or use the invention within the meaning of 35 U.S.C. § 112, first paragraph.

C. Whether Claims 1, 7 and 8 are indefinite within the meaning of 35 U.S.C. § 112, second paragraph for reciting two coefficients of thermal expansion.

VII. Grouping of Claims

Claims 1-18 do not stand or fall together. The claims are grouped according to the independent claims as follows: (i) independent Claim 1 and dependent Claims 2-6; (ii) independent Claim 7; (iii) independent Claim 8; (iv) independent Claim 9 and dependent Claims 10-15; (v) independent Claim 16 and dependent Claim 17; and (vi) independent Claim 18. For each ground of rejection appealed herein which applies to a group of two or

more claims, the groups of claims do not stand or fall together. In the arguments below individual grounds for the patentability of each group of claims is provided.

VIII. Arguments

Independent Claims 1, 7 and 8 require that the alloy have a martensitic transformation start point of less than -50°C and an average coefficient of thermal expansion measured between 20°C and 100°C of $\leq 0.7 \times 10^{-6}$/K and a mean coefficient of thermal expansion measured between 80°C and 130°C of $\leq 1 \times 10^{-6}$/K. Independent Claims 1 and 7-8 also limit the amount of cobalt and nickel present in the alloy and their interrelationship. Other elements including manganese are also limited.

Independent Claims 1, 7 and 8 are drawn to an Fe-Ni-Co alloy, a shadow mask, and a method for forming a shadow mask, respectively. Claims 1-7 and 8 are drawn to different statutory classes as defined in 35 U.S.C. § 101 (a composition of matter, an article, and a method, respectively) and are separately patentable over the prior art of record.

Independent Claims 9, 16 and 18 are drawn to an Fe-Ni-Co alloy, a shadow mask, and a method for forming a shadow mask. Claims 9, 16 and 18 are drawn to different statutory classes as defined in 35 U.S.C. § 101 and are separately patentable over the prior art of record.

Independent Claims 9, 16 and 18 contain the transitional phrase "consisting essentially of" thereby excluding additional components from the alloy composition that materially affect the basic and novel characteristics of the alloy defined by the elements recited in the claims.

The alloys recited in Claims 9-18 are required to exhibit a martensitic transformation start point of -186°C which is substantially lower than the martensitic transformation start point recited in independent Claims 1, 7 and 8 (-50°C). Independent Claims 9, 16 and 18 are

separately patentable as evidenced at least in part by (i) the exclusion of materials in the alloy composition that may materially affect the basic and novel characteristics of the alloy and (ii) the alloys' physical properties which include a martensitic transformation start point that is more than 100K lower than that of independent Claims 1, 7 and 8 (see further discussion below).

A. The unobviousness of claims 1-18 in view of Inoue (U.S. 5,234,512), Fukuda (U.S. 5,236,522), Ishikawa (U.S. 4,832,908) and/or Kato (U.S. 5,164,021).

One of the prior art references (Fukuda) cited by the Office in the rejection of independent Claims 1 and 7-8 as obvious states with regards to the Mn content: "[a]ny content below 0.1% would assure no appreciable improvement in forging adaptability" (column 2, lines 58-65). Therefore, the Fukuda reference states that alloys containing less than 0.1% Mn are not desirable and would not provide the physical characteristics desired of the alloy or articles derived from the alloy. In the presently claimed invention the Mn content is limited to $\leq$ 0.1%. It is disclosed in the present specification that: "...in order for the mean coefficient of expansion between 20° and 100°C to be less than or equal to 0.7 x 10^{-6}/K, it is preferable for each of the manganese, silicon and chromium contents to be less than or equal to 0.1%" (page 5, lines 5-9). Thus it is presently disclosed that an Mn content of less than 0.1% is an important determinant of the coefficient of expansion. In contrast, Fukuda discloses that the amount of Mn required in the prior art invention is greater than the amount allowable in the presently claimed alloy. Fukuda states that this Mn level is necessary to obtain an alloy composition having the desired physical properties.

Combining the disclosure of the Fukuda reference with the other references relied upon by the Office to render the presently claimed invention obvious makes no sense in view of the fact that Fukuda teaches that at least one element of the presently claimed alloy composition must be present in an amount greater than that allowed by the present

independent claims. Similarly, the Kato patent permits Mn to be present at a concentration of < 1% while Ishikawa allows Mn to be present at a concentration of 0.005 to 0.70%.

An Mn content of less than 0.1% is nowhere disclosed in the Examples of the Fukuda patent. In each of the Examples presented in Tables 1, 3 and 5 of Kato nowhere is a Mn concentration provided which is within the presently claimed range. Although Kato recognizes that Mn may impair an initial low thermal expansion, the reference does not recognize the importance of maintaining Mn at a level below 0.1% as presently claimed. Even if this disclosure were to suggest levels of Mn below 0.1%, when considered as a whole, the prior art reference teaches those of ordinary skill in the art that alloy compositions having amounts of Mn that are greater than that is allowed in the present claims are favored.

Ishikawa discloses a single example (Test Piece No. 35 in Table 1) having an Mn content of less than 0.1%. However this example has a silicon content outside the presently claimed range (0.17% vs. 0.1% max).

Therefore, based upon the maximum amount of Mn allowed in the present alloy composition, the prior art references relied upon by the Office teach away from the claimed composition and instead favor compositions wherein the amount of Mn is greater than the maximum amount allowed by the present independent claims.

At least the Fukuda reference is therefore not fairly applied against the present claims as pertinent prior art as evidenced by the contradictory teachings of the reference. At least this reference should be withdrawn and any rejection in view of the patent should be reversed.

The Office has indicated that the difference between the Inoue reference and the present claims includes Inoue's failure to contain Co (see paragraph 12 of the Office action of September 9, 2002). Cobalt is a required element of the presently claimed alloy composition. Cobalt's absence in the claimed alloy would provide an alloy which does not meet the present

claim limitations with regard to the compositional or performance (i.e., physical properties) requirements. The rejection of the present claims, wherein Co is required, in view of a reference in which Co is not identified as a necessary or critical element makes no sense. In order for those of ordinary skill in the art to duplicate or be led to the presently claimed invention from the disclosure of Inoue the reference must provide a competent teaching towards the inclusion of Co in order to achieve improved alloy performance.

Further, Inoue provides no disclosure that an interrelationship between Co and Ni elements is necessary in order to achieve an alloy composition which is able to provide the martensitic transformation start point and thermal expansion coefficient performance of the presently claimed compositions. For at least these reasons the rejection of the claims in view of the Inoue patent should be withdrawn and the rejections in view of the Inoue patent reversed.

None of Inoue, Ishikawa or Kato disclose compositions which adhere to all of the present claim limitations or overlap with the range of each claimed element. Inoue does not require the inclusion of cobalt, a necessary element of the presently claimed compositions. Ishikawa requires a greater amount of carbon than is allowed in the present claims (0.02% max vs. 0.2% min (see Abstract of Ishikawa)). Kato permits Mn at a concentration that is greater than that of the maximum concentration allowed herein (0.1% max vs. 1% max).

Each of the Inoue, Ishikawa and Kato patents fails to recognize the importance of one or more of the ranges limited in the claimed alloy composition. The Office has selected teachings from one or more of the prior art reference cited by the Office to render the presently claimed invention obvious. The Office has collected a series of references (which each individually suffer from a severe deficiency with regards to the presently claimed composition) then assembled the necessary element ranges to render the claimed invention obvious. It appears that this selection was accomplished with the benefit of hindsight using

Applicants' claimed invention as a template for assembling a *prima facie* case of obviousness. Such hindsight examination is an improper basis from which to determine obviousness. If the Office takes the position that the Examiner is obligated only to take into account that knowledge which was within the level of ordinary skill at the time the claimed invention was made in order the render the invention obvious, it begs the question why the presently claimed invention was not earlier claimed or disclosed in one or more of the prior art references and further why the prior art references contain disclosure which specifically avoids and teaches away from the presently claimed alloy.

Applicants submit that none of a claimed composition (e.g., invention of Claim 1), an article containing a material of this composition (e.g., shadow mask of Claim 7), or a method of forming a shadow mask (e.g., invention of Claim 8) are disclosed or suggested by the prior art references and the inventions of independent Claims 1 and 7-8 are separately patentable over the prior art of record..

Further, with regards to independent Claims 9, 16 and 18, the martensitic transformation start point is limited to less than -186°C, the thermal coefficient of expansion between 20°C to 100°C is limited to from 0.49×10^{-6} to 0.7×10^{-6}/K and the compositions are further limited by the transitional phrase "consisting essentially of" which excludes elements whose presence would otherwise materially effect the basic and novel characteristics of the claimed invention.

No such composition (e.g., invention of Claim 9), article containing a material of this composition (e.g., shadow mask of Claim 16), or method of forming a shadow mask (e.g., invention of Claim 18) is disclosed or suggested by the prior art references. In fact, in the prior art reference which discloses thermal expansion properties (<u>Fukuda</u>), it is disclosed that the prior art compositions have a thermal coefficient of expansion that is preferably less than 0.49×10^{-6}. The <u>Fukuda</u> patent also discloses compositions having a thermal coefficient of

expansion greater than the upper limit presently claimed of 0.7×10^{-6} but does not disclose compositions having a thermal coefficient of expansion lying in the presently claimed range.

The Office appears to be asserting that the compositions of one or more of the prior art references would inherently have the martensitic transformation start point and/or thermal coefficient of expansion properties of the presently claimed invention (e.g., independent Claims 9, 16 and 18). Applicants have provided an example in the specification as originally filed (Sample A) which has a composition which meets the requirements of Ni, Co, Mn and Si content of Ishikawa and Ni, Co, Si and C content of Fukuda. The martensitic transformation start point of this material is only -90°C which is greater than the -186°C or less required in Claims 9, 16 and 18. Even though the Sample A composition falls within at least some of the compositional requirements of the prior art references, it is unable to provide the martensitic transformation start point performance of present Claims 9, 16 and 18. Therefore, the martensitic transformation start point of less than -186°C recited in independent Claims 9, 16 and 18 is not a property inherent to the Ishikawa or Fukuda compositions.

There is no disclosure in any of the prior art references cited by the Office that the presently claimed thermal coefficient of expansion properties and martensitic transformation start points are inherent to the prior art compositions or are achievable when the cobalt and nickel interrelationships meet the present claim limitations and the other elements are present in the presently claimed quantities. For the reasons given above, the rejections of independent Claim 9, 16 and 18 should be withdrawn and the rejections reversed.

With regard to the subject matter of the dependent claims, dependent Claims 10 and 17 limit the average coefficient of thermal expansion of the composition of Claim 9 and the shadow mask of Claim 16 respectively to an even narrower level (from 0.65×10^{-6}/K to 0.49×10^{-6}/K). None of the prior art compositions are disclosed to have an average coefficient of

thermal expansion within the range claimed in dependent Claims 10 and 17. Since the prior art applied by the Office does not disclose the limitations of present Claims 10 and 17 the claims should not be obvious in view of the applied art and the rejections should be reversed.

Dependent Claims 2 and 11 further limit the claimed compositions of Claims 1 and 9 by limiting the amount of Cu, Mo, V, and Nb present in the alloy. Such limitations are not disclosed in the prior art disclosure. Since the prior art applied by the Office does not disclose the limitations of present Claims 2 and 11 the claims should not be obvious in view of the applied art and the rejections should be reversed.

Claims 3 and 12 further limit the alloy composition of Claims 1 and 9 with regards to the content of Mn, Si, Cr, Cu, Mo, V, and Nb where the sum of the concentrations of these elements must be < 0.3%. None of the prior art references cited by the Office limit the elements as recited in present Claims 3 and 12 in this manner. The further limitation of the elements provided in Claims 3 and 12 is therefore not obvious in view of the prior art references and the rejections of Claims 3 and 12 should be reversed.

Claims 4 and 13 limit the concentration of main group materials such as oxygen, nitrogen and phosphorous in the claimed alloy of Claims 1 and 9. Such further limitations of the alloy compositions are not disclosed in the Ishikawa, Fukuda or Kato prior art references cited by the Office. The rejection of Claims 4 and 13 in view of the aforementioned prior art should therefore be reversed.

B. The subject matter of Claims 1-18 was described in the specification in such a way as to permit one to make and/or use the invention within the meaning of 35 U.S.C. § 112, first paragraph.

In the Office Action of September 23, 2002, the Office asserted that Claims 1-18 contain subject matter which was not described in such a way as to enable one skilled in the

art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The specification as originally filed discloses that in order to reduce image defects caused by local heating in shadow masks, an average coefficient of expansion that is as low as possible between 20°C and 100°C and a mean coefficient of thermal expansion between 80°C and 130°C that is as low as possible is necessary. Further, the micrographic structure (i.e., microstructure) should be stable down to at least -50°C (see paragraph bridging pages 3 and 4 of the present specification). The composition of the alloy with regards to its cobalt and nickel content is believed to allow the mean coefficient of thermal expansion to be less than 0.7×10^{-6}/K when the cobalt and nickel contents adhere to the limitations of the present independent claims (see last paragraph on page 4). Therefore, in order to achieve a low coefficient of thermal expansion and a low martensitic transformation start point an alloy that contains both cobalt and nickel must meet the interrelationship requirements in the independent claims where the both cobalt and nickel are recited. Further restrictions are placed upon other elements such as silicon, chromium and carbon in order to maintain the low coefficient of expansion and low martensitic transformation start point (page 5, lines 5-9).

The specification as originally filed describes four alloys Samples A, B, C and D in the Examples on pages 6 and 7. At least three of the Examples (Samples B, C and D) describe alloy compositions wherein a martensitic transformation start point of "< -186" °C is disclosed. A mean coefficient of expansion between 20°C and 100°C of $< 0.7 \times 10^{-6}$/K is disclosed on page 5, line 7 and a mean coefficient of expansion of 0.49×10^{-6}/K is disclosed for Example C on page 7. Therefore, the specification as originally filed fully supports the claim limitations in the independent claims wherein the martensitic transformation start point is limited to less than -50°C (independent Claims 1 and 7-8) or < -186°C (independent Claims 9, 16 and 18).

As noted above, the specification as originally filed describes alloy compositions meeting the requirements recited in the present independent claims. Further, the Office has stated:

> "it is unclear why the examples (A to D) in pages 6-7 of the instant specification have different martensitic transformation start points and thermal coefficients of expansion since compositions of all examples are in the claimed ranges and also complied with the claimed equations. There is no teaching to obtain the martensitic transformation start points < -186 and/or thermal coefficients of expansion $0.49 \times ^{-6}$ to $0.7 \times ^{-6}$." (Office Action of September 23, 2002; page 2, paragraph no. 3).

Nowhere in the patent statute or administrative procedures of the U.S. Patent and Trademark Office is it a requirement that Inventors provide a description of why or how a claimed invention works. The specification needs to provide a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same (35 U.S.C. § 112, first paragraph).

The specification as originally filed describes maintaining the cobalt and nickel contents of the alloy composition within certain ranges together with limitations on the contents of other elements (i.e., a way to carry out the invention). The compositional and physical property limitations provided in the present independent claims are unique characteristics which define the claimed alloy compositions and provide those of ordinary skill in the art the guideposts necessary to reproduce the claimed alloy compositions. Therefore, the rejection of Claims 1-18 under 35 U.S.C. §112, first paragraph should be reversed.

C. <u>Indefiniteness of Claims 1, 7 and 8 within the meaning of 35 U.S.C. § 112, second paragraph.</u>

The Office rejected Claims 1-8 under 35 U.S.C. § 112, second paragraph noting that the limitations in independent Claims 1 and 7-8 (which provide two coefficients of thermal

expansion) are indefinite for failing to particularly point out and distinctly claim the subject matter regarded as the invention. It appears that the Office has asserted that a coefficient of thermal expansion measured between 20 and 100°C and between 80 and 130°C is overlapping limitation (e.g., a narrow range falling within a broad range). This is manifestly incorrect. An average coefficient of thermal expansion between two temperature limits is an average of the coefficient of thermal expansions measured between those temperature limits, similar to the way a volatile liquid may have different boiling temperatures between different pressure ranges. The Office has provided no reason why such a measurement is indefinite. Further, the Office has provided no evidence that an alloy cannot have different average coefficient of thermal expansions for different temperature ranges. Although the presently claimed limitations contain average and mean coefficient of thermal expansions measured between overlapping temperature ranges, this is not indefinite because those of ordinary skill in the art are provided with the upper and lower limits between which the average and mean coefficient of thermal expansions must be measured. It is irrelevant that the ranges overlap and such is not indicative of indefiniteness. For these reasons the rejection of Claims 1-8 under 35 U.S.C. § 112, second paragraph should be reversed.

For these reasons the rejections of the present claims should be reversed.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.

Norman F. Oblon
Attorney of Record
Registration No. 24,618

Stefan U. Koschmieder
Registration No. 50,238

Customer Number
22850

Tel: (703) 413-3000
Fax: (703) 413 -2220
(OSMMN 08/03)

NFO/SUK:sjh:bwt

APPENDIX I: CLAIMS

Claim 1. An Fe-Ni-Co alloy whose chemical composition comprises, by weight based on total weight:

$32\% \leq Ni \leq 34\%$

$3.5\% \leq Co \leq 6.5\%$

$0\% \leq Mn \leq 0.1\%$

$0\% \leq Si \leq 0.1\%$

$0\% \leq Cr \leq 0.1\%$

$0.005\% \leq C \leq 0.02\%$

$S \leq 0.001\%$

$0.0001\% \leq Ca \leq 0.002\%$

$0.0001\% \leq Mg \leq 0.002\%$

and further comprising iron and impurities resulting from smelting; the chemical composition of the alloy furthermore satisfying the relationships:

$Co + Ni \leq 38.5\%$

$Co + 0.5 \times Ni \geq 20\%$

$Co + 5 \times Ni \geq 165.5\%$

and

$S \leq 0.02 \times Mn + 0.08 \times Ca + 0.6 \times Mg$

wherein said alloy has a martensitic transformation start point of less than -50°C, an average coefficient of thermal expansion between 20° and 100°C of less than or equal to 0.7 x 10^{-6}/°K and a mean coefficient of thermal expansion between 80° and 130°C of less than or equal to 1 x 10^{-6}/°K.

Claim 2. The alloy as claimed in claim 1, wherein copper, molybdenum, vanadium and niobium contents are each present in less than 0.1%.

Claim 3. The alloy as claimed in claim 2, wherein the sum of the weight percentages of manganese, silicon, chromium, copper, molybdenum, vanadium and niobium is less than 0.3%.

Claim 4. The alloy as claimed in claim 1, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

Claim 5. The alloy as claimed in claim 2, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

Claim 6. The alloy as claimed in claim 3, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

Claim 7. A shadow mask, which comprises at least one foil having holes, said foil comprising an alloy whose chemical composition comprises, by weight based on total weight:

$32\% \leq Ni \leq 34\%$

$3.5\% \leq Co \leq 6.5\%$

$0\% \leq Mn \leq 0.1\%$

$0\% \leq Si \leq 0.1\%$

$0\% \leq Cr \leq 0.1\%$

$0.005\% \leq C \leq 0.02\%$

$S \leq 0.001\%$

$0.0001\% \leq Ca \leq 0.002\%$

$0.0001\% \leq Mg \leq 0.002\%$

and further comprising iron and impurities resulting from smelting; the chemical composition of the alloy furthermore satisfying the relationships:

$Co + Ni \leq 38.5\%$

$Co + 0.5 \times Ni \geq 20\%$

$Co + 5 \times Ni \geq 165.5\%$

and

$S \leq 0.02 \times Mn + 0.08 \times Ca + 0.6 \times Mg$

wherein said alloy has a martensitic transformation start point of less than -50°C, an average coefficient of thermal expansion between 20° and 100°C of less than or equal to 0.7 x 10^{-6}/°K and a mean coefficient of thermal expansion between 80° and 130°C of less than or equal to 1 x 10^{-6}/°K.

Claim 8. A method of forming a shadow mask, comprising the steps of forming holes in a foil and drawing said hole-containing foil, wherein the foil comprises an alloy having a chemical composition which comprises, by weight based on total weight:

$32\% \leq Ni \leq 34\%$

$3.5\% \leq Co \leq 6.5\%$

$0\% \leq Mn \leq 0.1\%$

$0\% \leq Si \leq 0.1\%$

$0\% \leq Cr \leq 0.1\%$

$0.005\% \leq C \leq 0.02\%$

$S \leq 0.001\%$

$0.0001\% \leq Ca \leq 0.002\%$

$0.0001\% \leq Mg \leq 0.002\%$

and further comprising iron and impurities resulting from smelting; the chemical composition of the alloy furthermore satisfying the relationships:

$Co + Ni \leq 38.5\%$

$Co + 0.5 \times Ni \geq 20\%$

$Co + 5 \times Ni \geq 165.5\%$

and

$S \leq 0.02 \times Mn + 0.08 \times Ca + 0.6 \times Mg$

wherein said alloy has a martensitic transformation start point of less than -50°C, an average coefficient of thermal expansion between 20° and 100°C of less than or equal to 0.7 x 10^{-6}/°K and a mean coefficient of thermal expansion between 80° and 130°C of less than or equal to 1 x 10^{-6}/°K.

Claim 9. An Fe-Ni-Co alloy consisting essentially of iron and:

$32\% \leq Ni \leq 34\%$

$3.5\% \leq Co \leq 6.5\%$

$0\% \leq Mn \leq 0.1\%$

$0\% \leq Si \leq 0.1\%$

$0\% \leq Cr \leq 0.1\%$

$0.005\% \leq C \leq 0.02\%$

$S \leq 0.001\%$

$0.0001\% \leq Ca \leq 0.002\%$

$0.0001\% \leq Mg \leq 0.002\%$

the chemical composition of the alloy furthermore satisfying the relationships:

$Co + Ni \leq 38.5\%$

$Co + 0.5 \times Ni \geq 20\%$

$Co + 5 \times Ni \geq 165.5\%$

wherein % is % by weight, and

$S \leq 0.02 \times Mn + 0.08 \times Ca + 0.6 \times Mg$

wherein said alloy has a martensitic transformation start point of less than -186°C and an average coefficient of thermal expansion between 20° and 100°C of from $0.7 \times 10^{-6}/K$ to $0.49 \times 10^{-6}/K$.

Claim 10. The alloy as claimed in Claim 9, wherein the average coefficient of thermal expansion is from $0.65 \times 10^{-6}/K$ to $0.49 \times 10^{-6}/K$.

Claim 11. The alloy as claimed in Claim 9, wherein copper, molybdenum, vanadium and niobium are each present in amounts less than 0.1%.

Claim 12. The alloy as claimed in Claim 11, wherein the sum of the weight percentages of manganese, silicon, chromium, copper, molybdenum, vanadium and niobium is less than 0.3%.

Claim 13. The alloy as claimed in Claim 9, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

Claim 14. The alloy as claimed in Claim 11, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

Claim 15. The alloy as claimed in Claim 12, wherein the oxygen content is less than or equal to 0.01%, the nitrogen content is less than or equal to 0.005%, and the phosphorus content is less than or equal to 0.005%.

Claim 16. A shadow mask, which comprises at least one foil having holes, said foil comprising an alloy, said alloy consisting essentially of iron and

$32\% \leq Ni \leq 34\%$

$3.5\% \leq Co \leq 6.5\%$

$0\% \leq Mn \leq 0.1\%$

$0\% \leq Si \leq 0.1\%$

$0\% \leq Cr \leq 0.1\%$

$0.005\% \leq C \leq 0.02\%$

$S \leq 0.001\%$

$0.0001\% \leq Ca \leq 0.002\%$

$0.0001\% \leq Mg \leq 0.002\%$

the chemical composition of the alloy furthermore satisfying the relationships:

$Co + Ni \leq 38.5\%$

$Co + 0.5 \times Ni \geq 20\%$

$Co + 5 \times Ni \geq 165.5\%$

wherein % is % by weight, and

$S \leq 0.02 \times Mn + 0.08 \times Ca + 0.6 \times Mg$

wherein said alloy has a martensitic transformation start point of less than -186°C and an average coefficient of thermal expansion between 20° and 100°C of from 0.7×10^{-6}/K to 0.49×10^{-6}/K.

Claim 17. The shadow mask of Claim 16, wherein the average coefficient of thermal expansion is from 0.65×10^{-6}/K to 0.49×10^{-6}/K.

Claim 18. A method of forming a shadow mask, comprising

forming holes in a foil and

drawing said hole-containing foil,

wherein said foil comprises an alloy consisting essentially of iron and

$32\% \leq Ni \leq 34\%$

$3.5\% \leq Co \leq 6.5\%$

$0\% \leq Mn \leq 0.1\%$

$0\% \leq Si \leq 0.1\%$

$0\% \leq Cr \leq 0.1\%$

$0.005\% \leq C \leq 0.02\%$

$S \leq 0.001\%$

$0.0001\% \leq Ca \leq 0.002\%$

$0.0001\% \leq Mg \leq 0.002\%$

the chemical composition of the alloy furthermore satisfying the relationships:

$Co + Ni \leq 38.5\%$

$Co + 0.5 \times Ni \geq 20\%$

$Co + 5 \times Ni \geq 165.5\%$

wherein % is % by weight, and

$S \leq 0.02 \text{ x } Mn + 0.08 \text{ x } Ca + 0.6 \text{ x } Mg$

wherein said alloy has a martensitic transformation start point of less than -186°C and an average coefficient of thermal expansion between 20° and 100°C of from $0.7 \text{ x } 10^{-6}$/K to $0.49 \text{ x } 10^{-6}$/K.

APPENDIX II: RELATED APPEALS

Copies of the Appeal Brief, Examiner's Answer, Reply Brief and Decision on Appeal from parent application U.S. Application Serial No. 08/641,233 filed on April 30, 1996, now abandoned, are attached.